CMMS Technical Working Group

JSIMS, JWARS, and DMSO Conceptual Model Integration

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CMMS

- **CMMS is a Rigorous Description of Military Operations which are**
  - **Derived from Authoritative Data Sources (ADS)**
  - **Described using Common Syntax and Semantics (CSS)**
  - **Independent of any particular simulation implementation**

- **As employed by JSIMS, JWARS, and DMSO, CMMS is**
  - **The disciplined procedure by which the simulation developer is systematically informed about the real world to be synthesized.**
  - **The information structure that the simulation subject matter expert employs to communicate with and obtain feedback from the military operations subject matter expert**
  - **The real world operations basis for subsequent, simulation-specific analysis, design, and implementation decisions**
  - **A singular means for identifying re-use opportunities in the eventual simulation implementation by establishing commonality in the real world activities**

Every Simulation has a Focus

- **Entities/Actions Near the Focus are Represented with**
  - **Fine-Grained Decomposition**
  - **Extensive Detail**

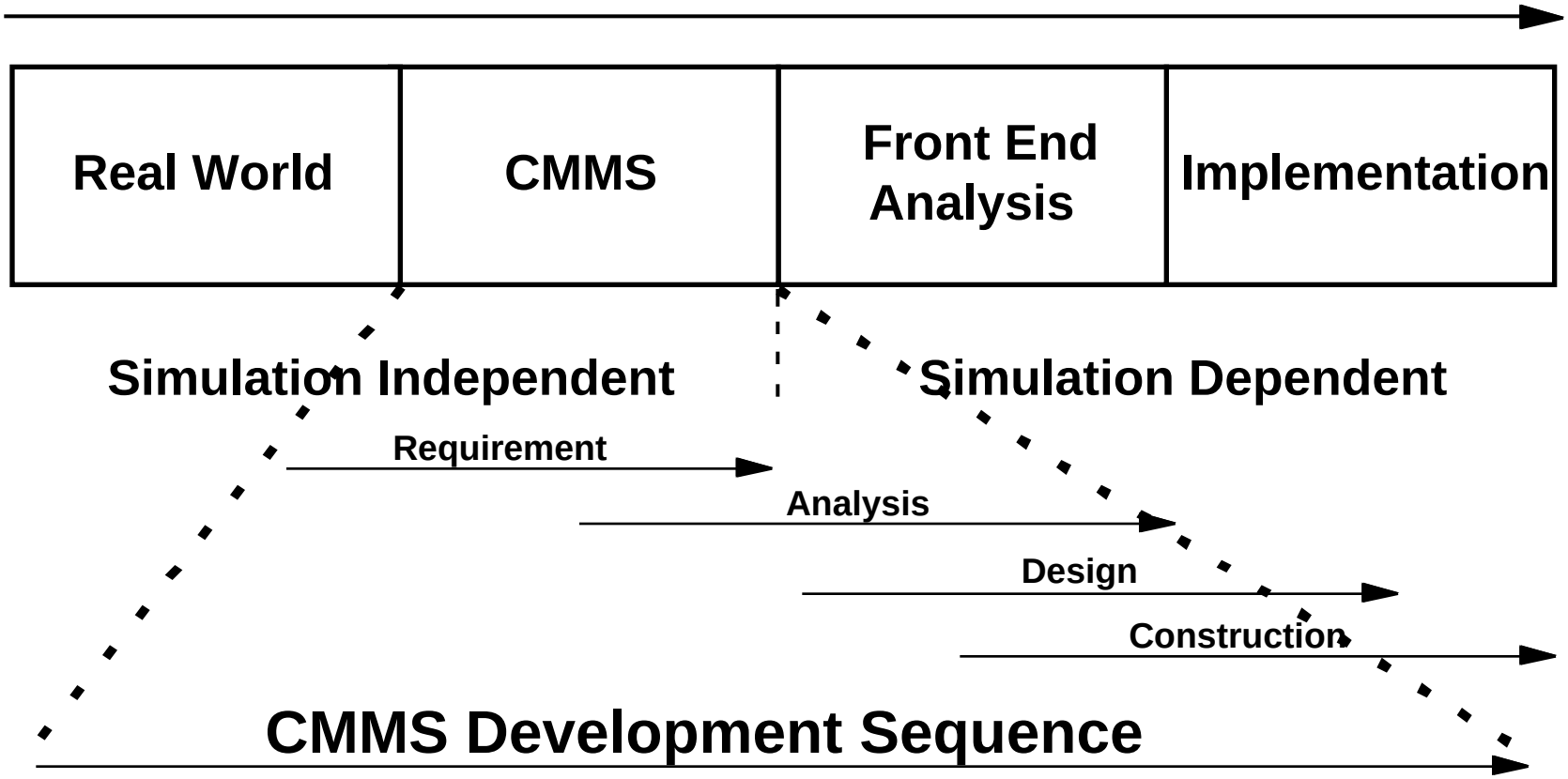
- **Entities/Actions Distant from the Focus are Represented with**
  - **Coarse-Grained Decomposition**
  - **Limited Detail**

- **CMMS supports Critical simulation development Decisions**
  - **Informs the Sim Developer about the Real World → Build the System**
  - **Informs the Warfighter about the Simulation → VV&A/C**

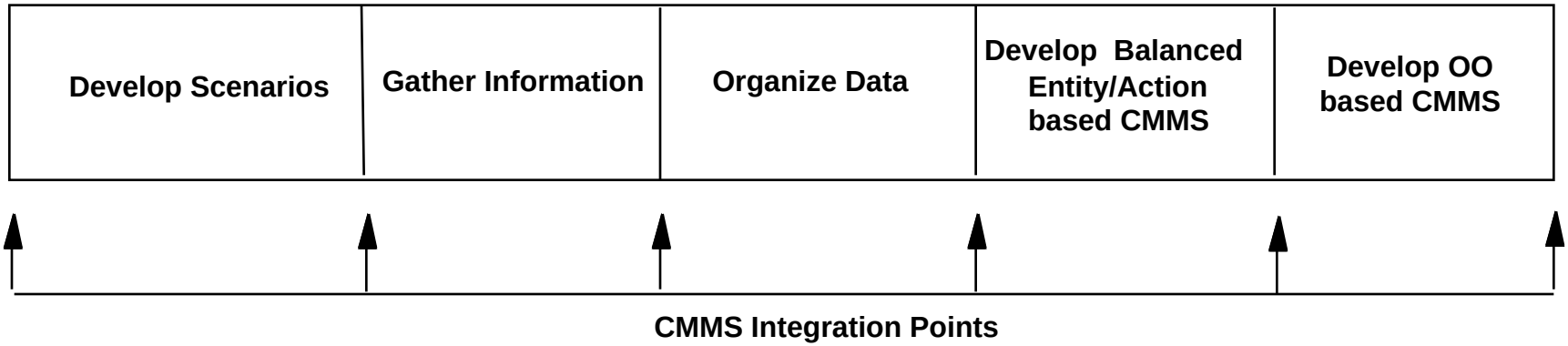
CMMS as Systems Engineering

- **A key CMMS objective is to provide simulation developers with timely and cost-effective access to accurate mission space models which are created and authenticated by others. For example CMMS should enable direct use of**
  - **infantry engagement models developed by WarSim with**
  - **close air support models developed by NASM to describe**
  - **joint Air-Land Battle simulations to be built by JSIMS**
- **CMMS is an application of systems engineering practice to the "system of developing simulations". That is,**
  - **partition the system into standalone components with well defined interfaces, and**
  - **components interact/affect/communicate only through the interfaces**
- **CMMS is then the well-defined-interface which enables a rigorous systems engineering separation-of-concerns:**
  - **Between the military operations SME and the simulation SME, and**
  - **Between the respective Joint, Air, Land, Intel, etc.. SME's**

Simulation Development Sequence



CMMS Development Sequence



Warfighter View of Missions

- **Warfighter**
  - **My Brigade Commander briefed me on the upcoming assault**
  - **I figured out the best avenue of approach and wrote my Commander's Guidance**
  - **I briefed my Company Commanders and gave them Commander's Guidance**
- **CMMS**
  - **Mission: Assault on Facility; Task: Attend Mission Briefing; Interaction: Receive Mission Plan.**
  - **Task: Create Plan for employment of Battalion resources (Companies et al).**
  - **Task: Brief Company Commanders; Interaction: Initiate Mission Plan.**

CMMS to Front End Analysis

- **CMMS**
  - **Mission: Assault on Facility; Task: Attend Mission Briefing; Interaction: Receive Mission Plan.**
  - **Task: Create Plan for employment of Battalion resources (Companies et al).**
  - **Task: Brief Company Commanders; Interaction: Initiate Mission Plan.**

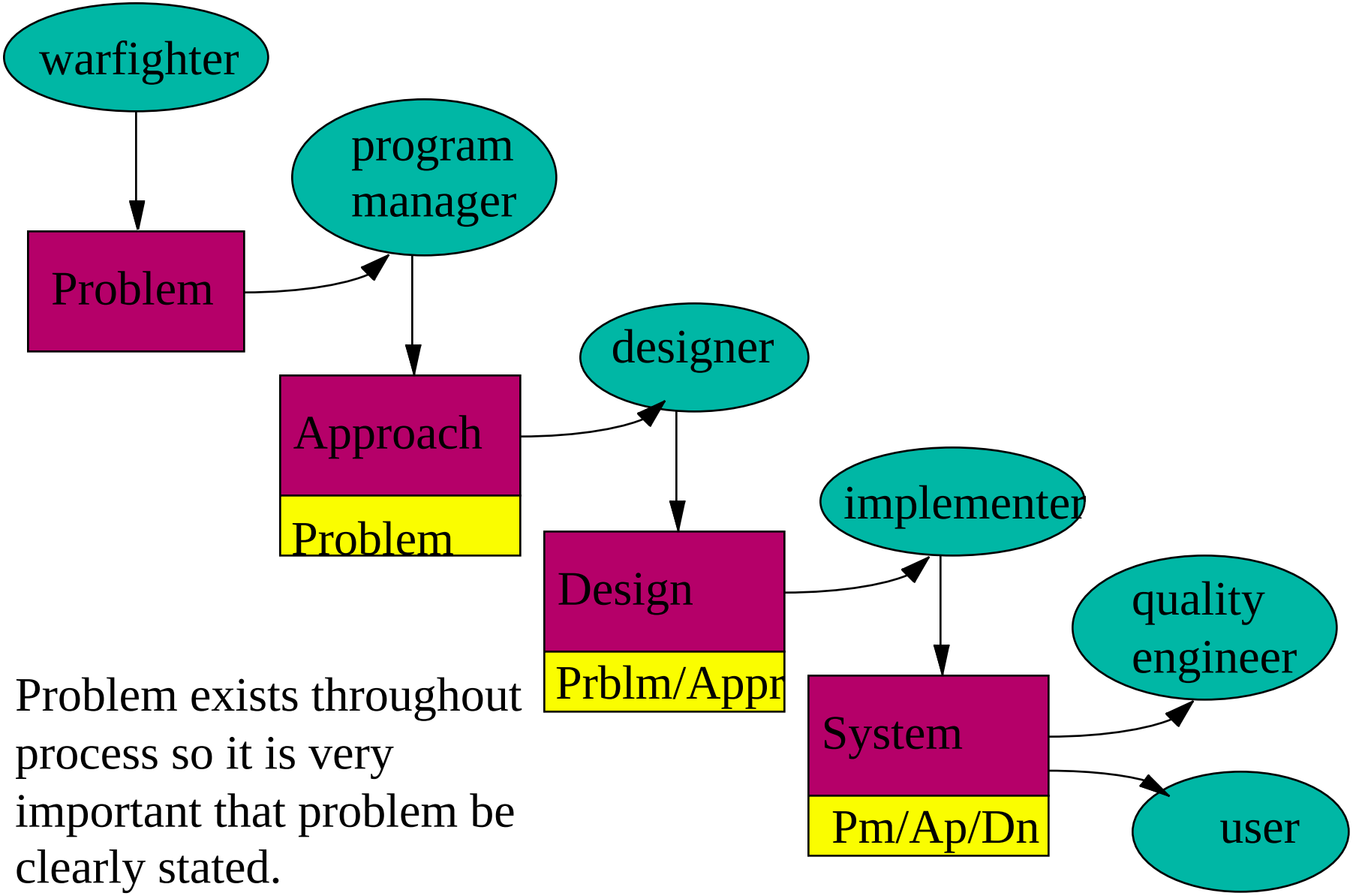
- **Front End Analysis**
  - **Instantiate Battalion Commander Actor Object; Initial States reflect Mission Plan (ready for next task).**
  - **Change States of Battalion Commander Object to reflect creation of Company employment plans.**
  - **Change States of Battalion Commander to reflect Company Commander briefings; Instantiate Company Commander Objects with initial states appropriate to mission.**

CMMS to Developer

- **CMMS**
  - **Mission: Assault on Facility; Task: Attend Mission Briefing; Interaction: Receive Mission Plan.**
  - **Task: Create Plan for employment of Battalion resources (Companies et al).**
  - **Task: Brief Company Commanders; Interaction: Initiate Mission Plan.**

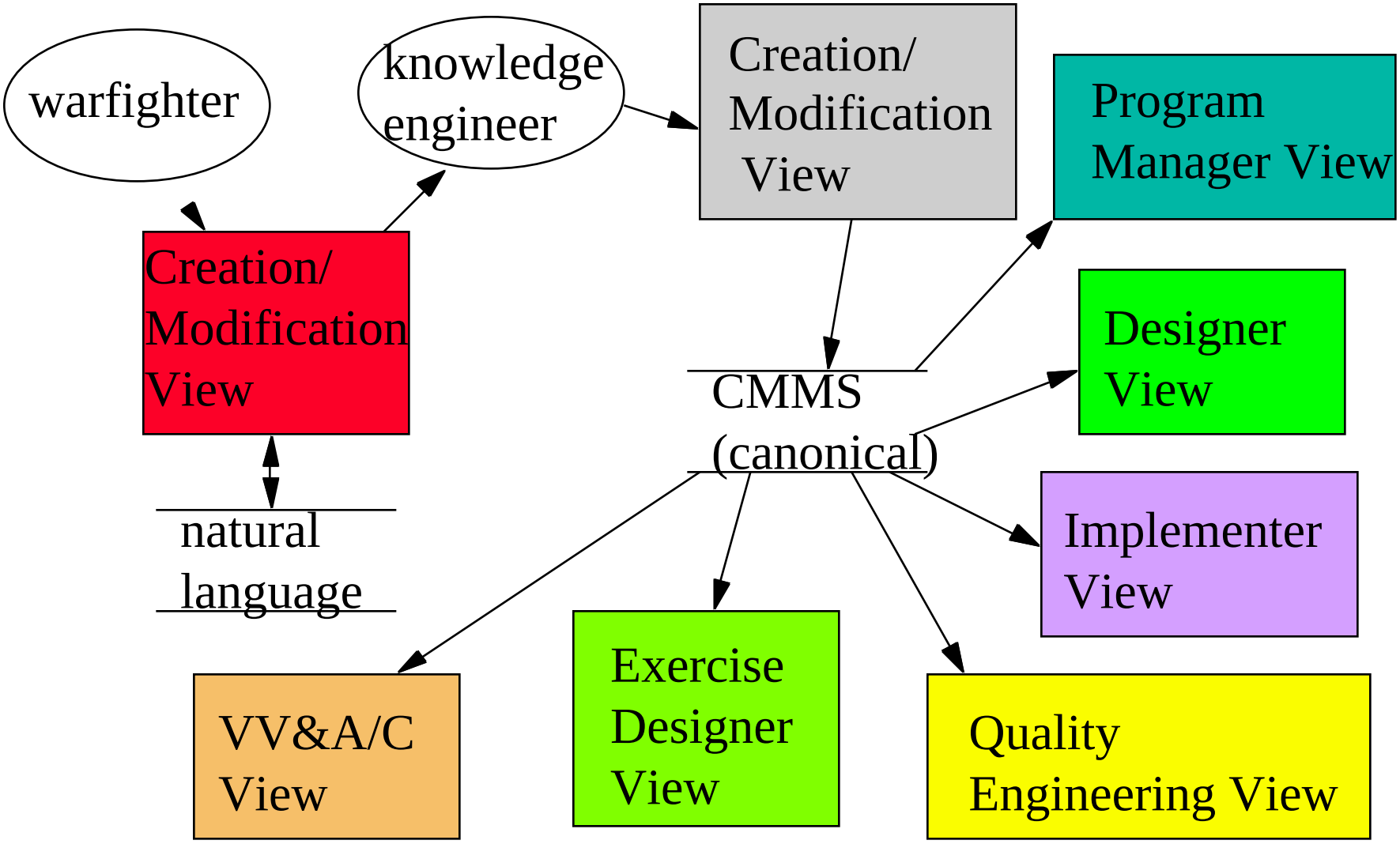
- **Developer**
  - **Instantiate Battalion Commander Object (Actor); Initial States reflect Mission Plan (ready for next task).**
  - **Change States of Battalion Commander Object to reflect creation of Company employment plans.**
  - **Change States of Battalion Commander to reflect Company Commander briefings; Instantiate Company Commander Objects with initial States appropriate to mission.**

Development Sequence



Problem exists throughout process so it is very important that problem be clearly stated.

Data-Centric Approach to CMMS Integration



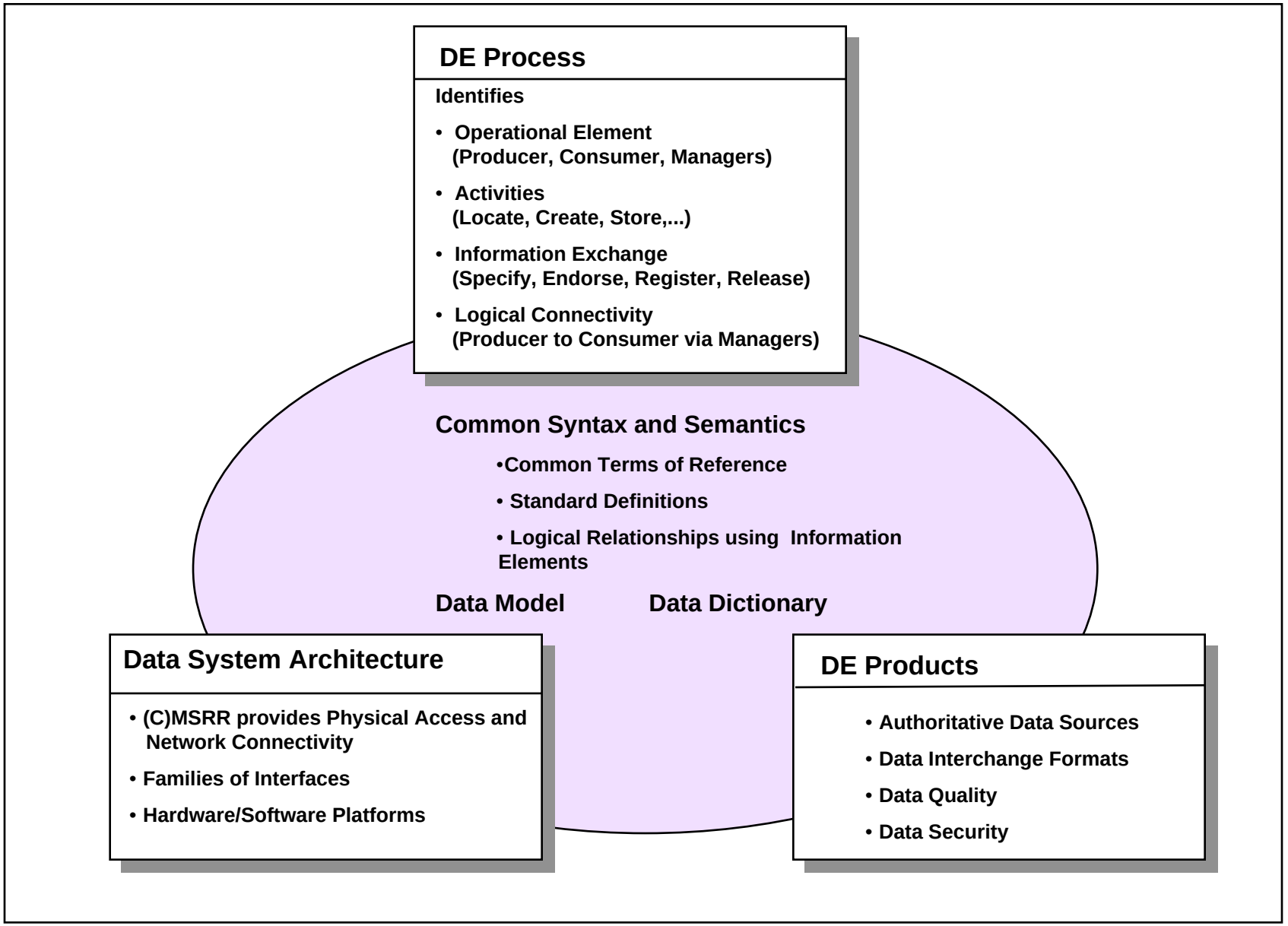
Data Centric CMMS Integration Means...

- **Using the CMMS Technical Framework to establish**
  - **a method-neutral Common Syntax and Semantics (CSS) using an entities, actions, tasks, and interactions (EATI) representation of military operations**
  - **a CASE tool-independent Data Interchange Format (DI-format) for the conversion, storage, integration, and extraction of CMMS models.**
  - **CASE method/tool-specific Style Guides**

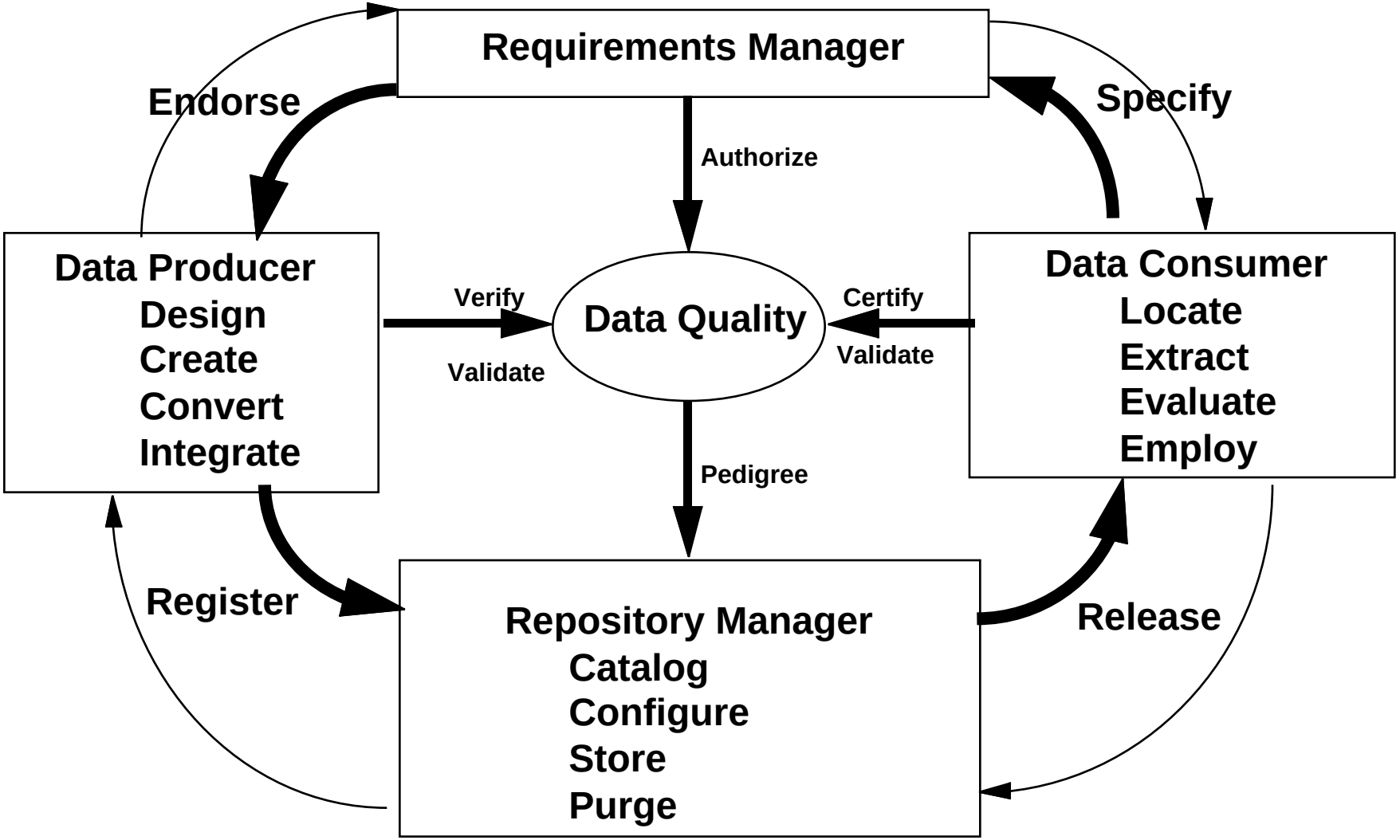
This Data-Centric Approach Will:

- **Provide a closed loop Data Engineering Process (DEP) to execute the complete CMMS model life-cycle:**
  - **from specification,**
  - **through model creation and registration**
  - **to configuration management and release, including**
  - **periodic maintenance and eventual removal**
- **Provide software tools and utilities to:**
  - **incorporate and enforce CSS**
  - **execute model integration and exchanges via DI-formats**
  - **identify and register CMMS Authoritative Data Sources**
  - **specify Data Quality (DQ) practices and record VV&A/C examinations**
  - **enforce Data Security (DS) practices for model protection and release**
- **Support a variety of structured views for model display and edit**
- **Employ the (C)MSRR for physical access and logical connection**

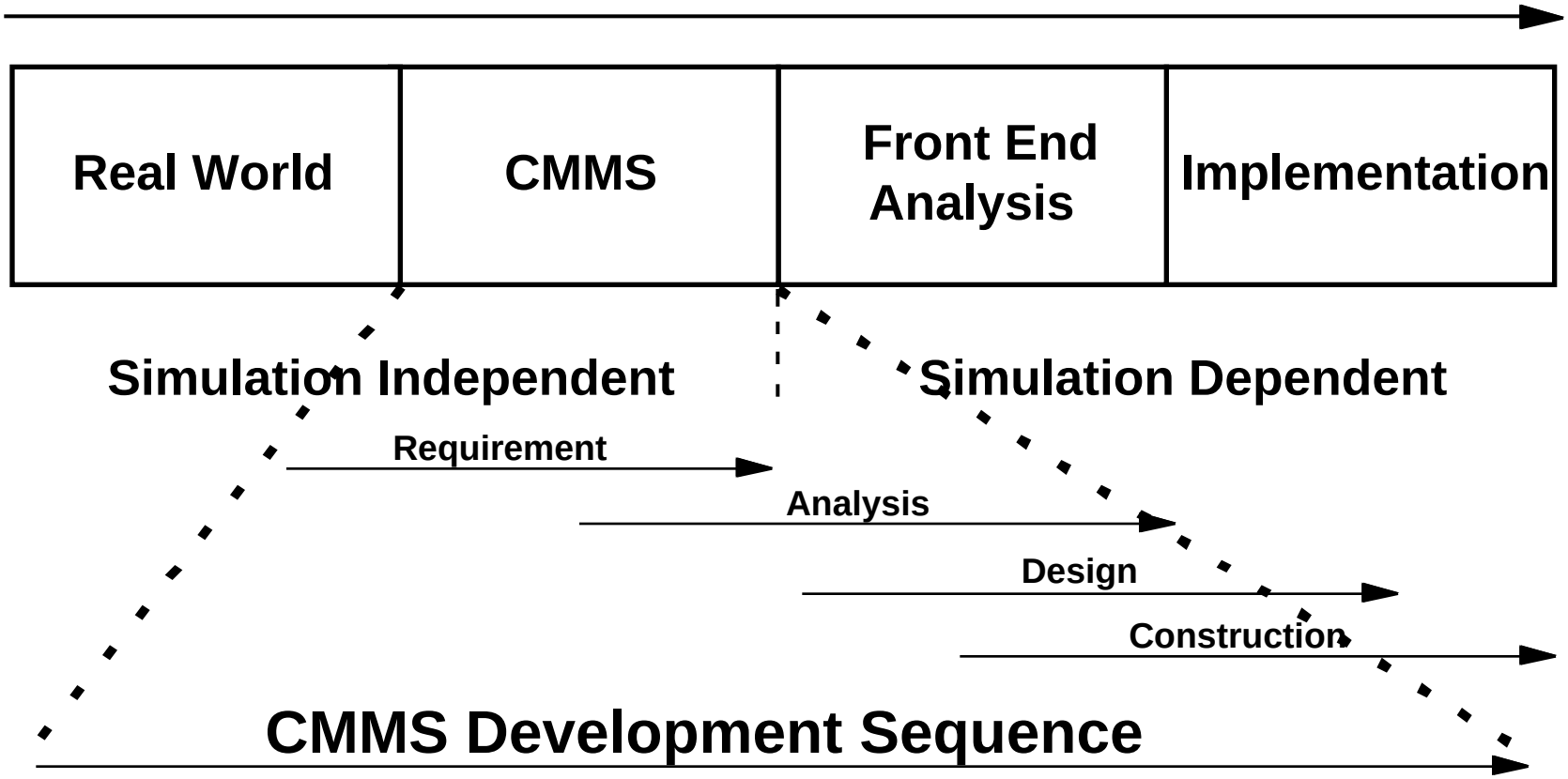
Data Engineering Technical Framework



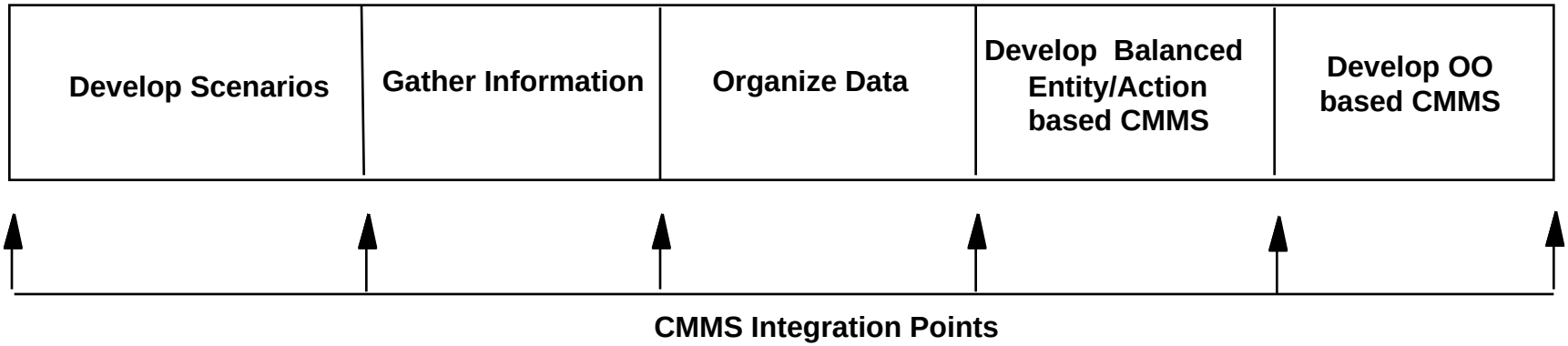
Data Engineering Process, Version 0.1.3



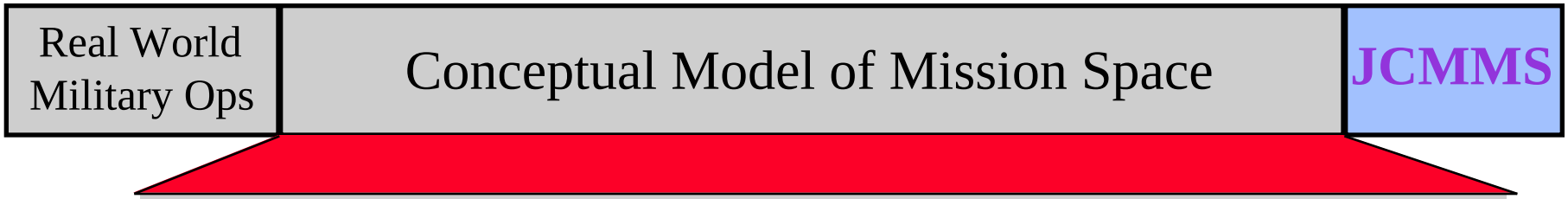
Simulation Development Sequence



CMMS Development Sequence



Coordinated Mission Space Development



Gather Info	Organize Info	Conceptual Model Construction
- Pubs, site visits - Formal & informal doctrine - General military info	- Structured text and diagrams -- Who, What, When, Where, Why -- Trigger/Inputs -- Outputs/Destination -- Exit/termination criteria	- Common Syntax & Semmantics - Data Interchange Format - Tool-specific style guides
1. J-8 & JWFC choose scenarios 2. JWFC unfolds scenario 3. DMSO provides forum	1. Common data collection templates -- Operations specification -- Use Case 2. First pass single transaction end-to-end; second pass to find branches	1. Inform self before making object decisions 2. Adaption, not promulgation 3. Substanative tech issue--action- based vs. entity based abstraction

Semantics Illustration

- **Consider similar operations in two different contexts**

Army Context

Warfighter Function - Protect Convoy
Common Semantic Reference - ***Defend***

Navy Context

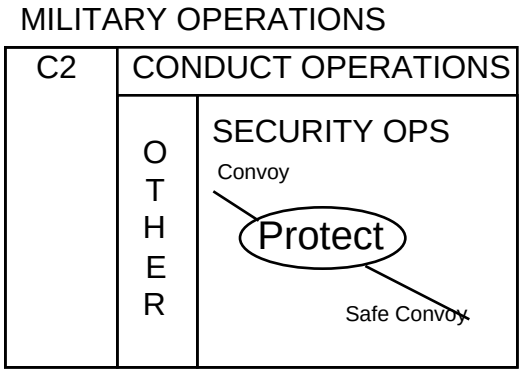
Warfighter Function - Defend BG
Common Semantic Reference - ***Defend***

- **Need to relate "Protect" to "Defend"**
  - **Establish a common underlying term for reference purposes**
  - **Establish a one-to-one correlation between terms and their accepted meanings or "senses"**
  - **Call it "Common Semantics"**

Syntax Illustration

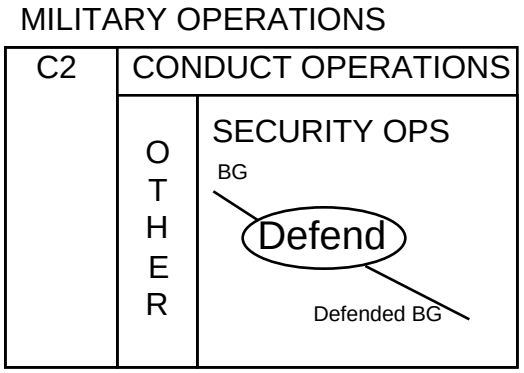
- **Consider the contexts of the two operations**

Army Context



Warfighter Function - Protect Convoy
Warfighting Context - Security Operations
Common Semantic Reference - ***Defend***

Navy Context



Warfighter Function - Defend BG
Warfighting Context - Security Operations
Common Semantic Reference - ***Defend***

- **To be meaningful, common semantics must be allowed to differ in different contexts**
- **Need to establish the context for this sense of "Defend"**
  - **Establish a generic syntax or structure of contexts**
  - **The common semantic term is valid within one of these contexts**
  - **Narrows the field enough to find similarities**
  - **Call it "Common Syntax" (where the word may be used)**

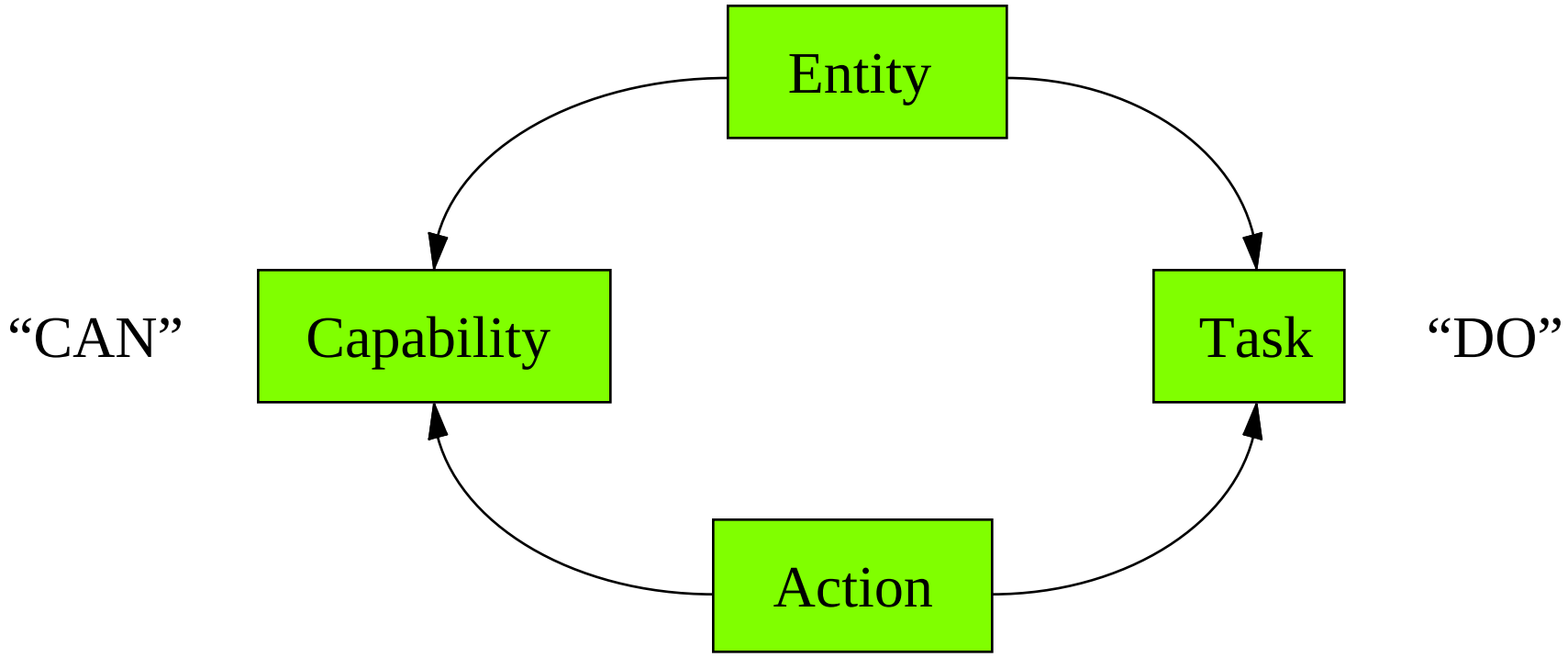
CMMS Verb Syntax

- **Command and Control**
  - Monitor Situation
  - Mission/Task Analysis
  - Course of Action Development
  - Supervise and Synchronize
- **Execution**
  - Move
  - Sense
  - Communicate
  - Engage
  - Replenish
  - Repair

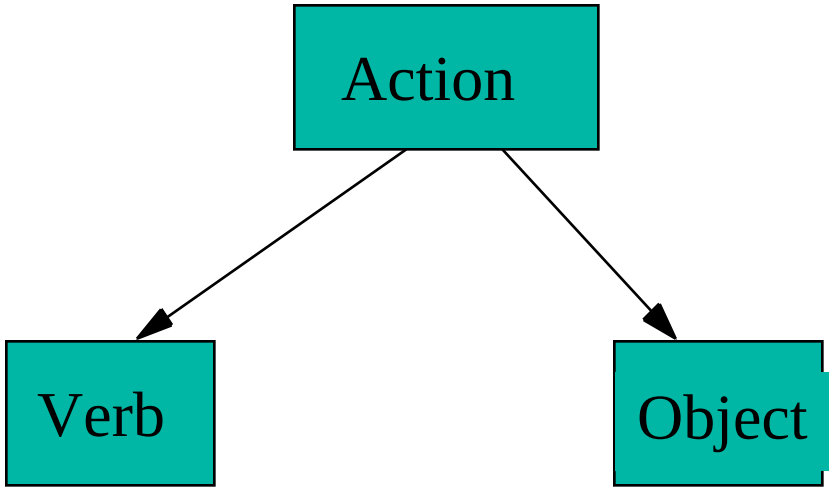
Common Syntax and Semantics

- **CSS for General Purpose Templates**
  - **Level-0 Unstructured Text, Freeform Diagrams**
  - **Level-1 IDEF0 Activity Model, IDEF1X Entity-Relationship Diagram**
  - **Level-2 CORE, STATEMATE, RDD-100 Process/Behavior Diagram**
  - **Level-3 Booch, Rumbaugh, Schler-Mellor, UML, IDEFObject, ...**
- **CSS for Structure and Content Specific to the Mission Space**
  - **Level-0 Flat Lexicon (HLA Lexicon)**
  - **Level-1 Global Namespace Data Dictionary**
  - **Level-2 Hierarchical Semantics with Derived Data Elements**
  - **Level-3 Multiple-Inheritance Data Elements**

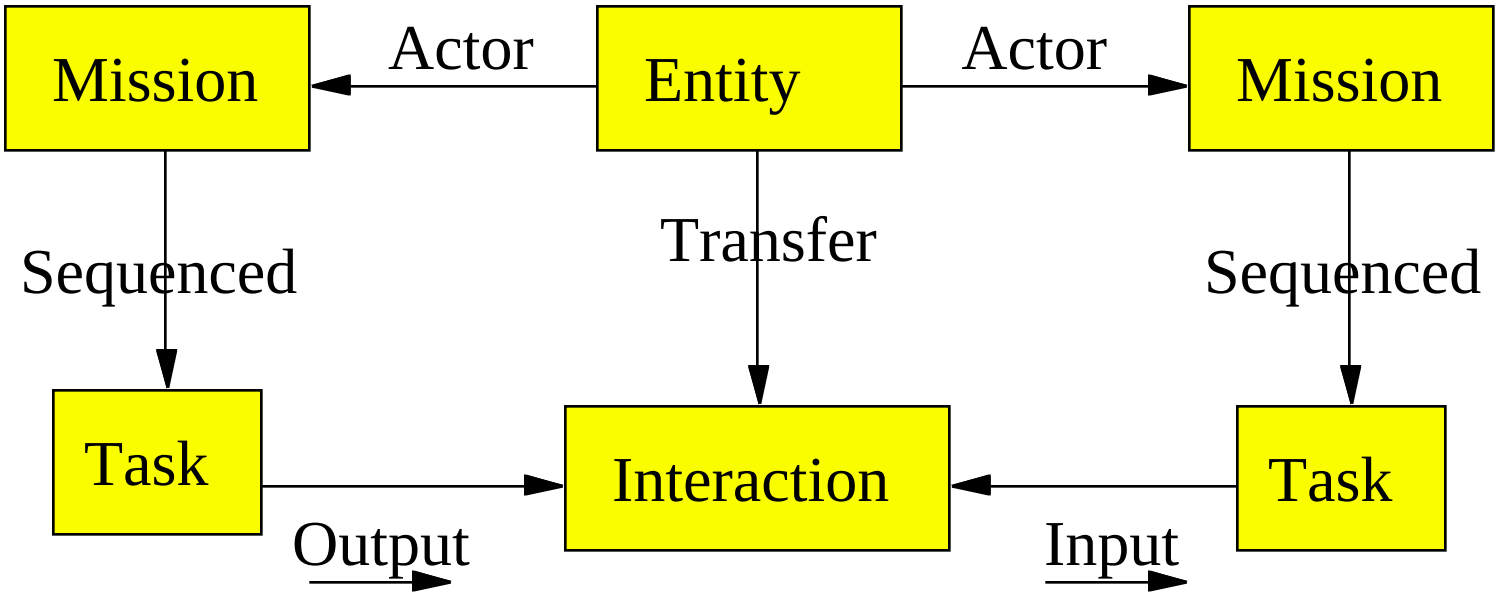
Entity-Action-Task-Capability



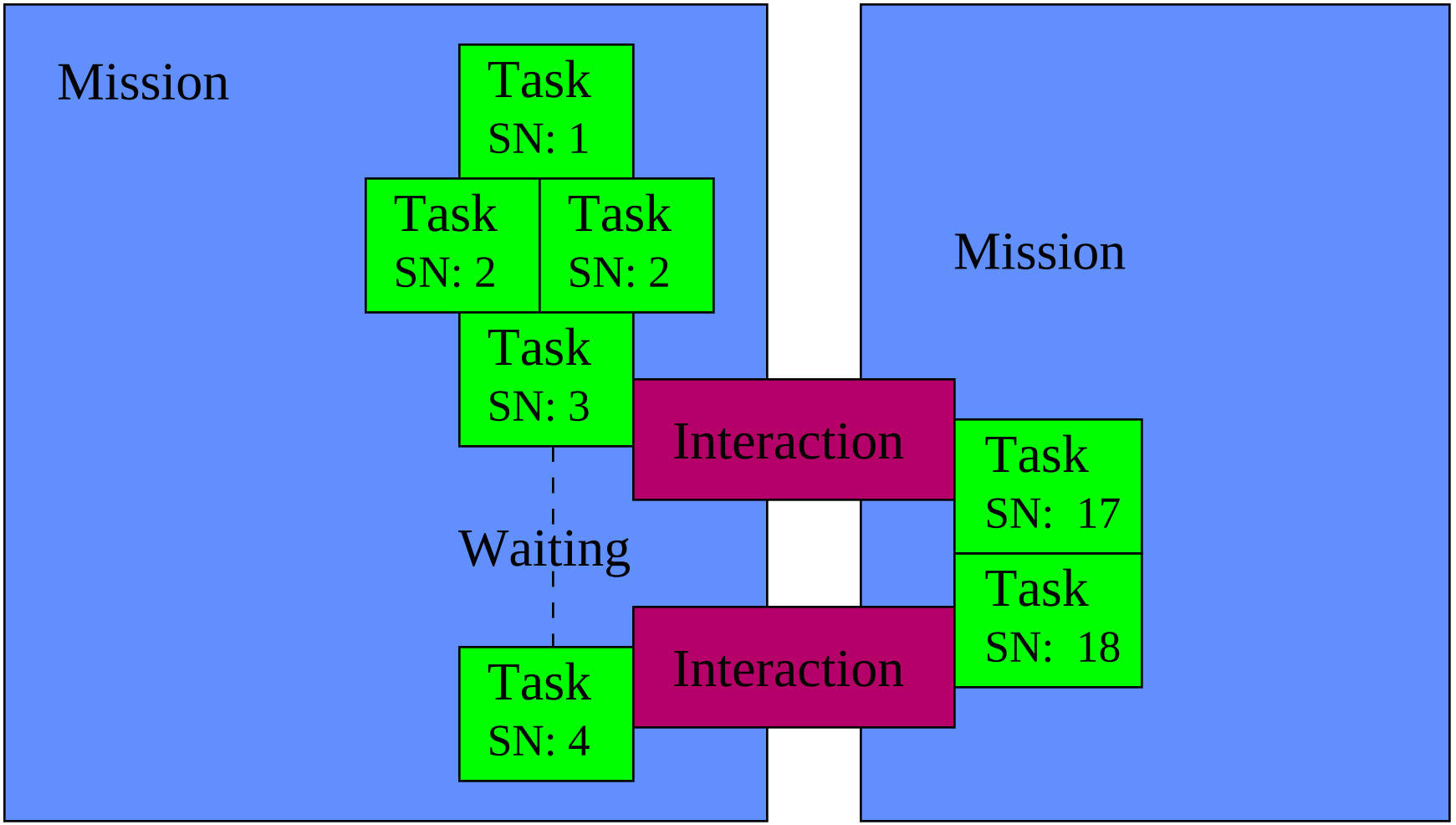
Action = Verb-Object defining a Role



Task-Interaction



Mission Threads



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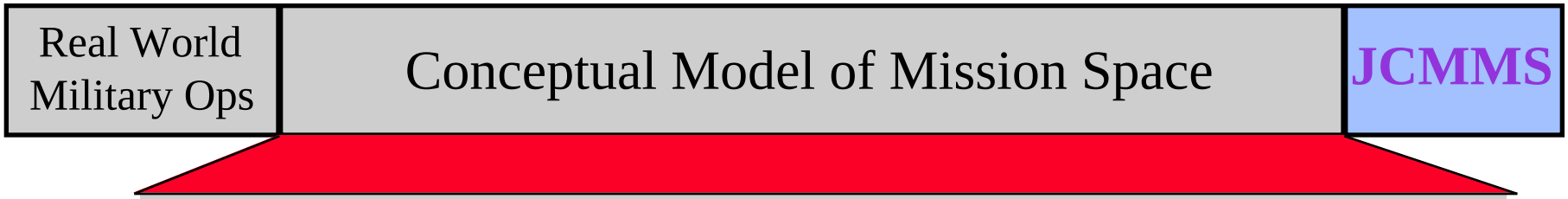

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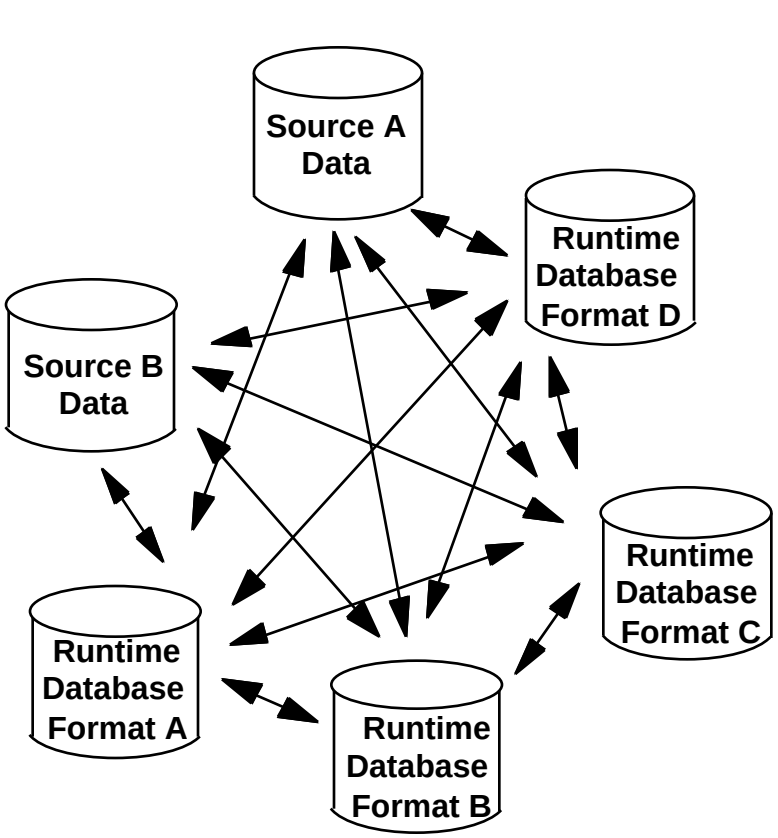
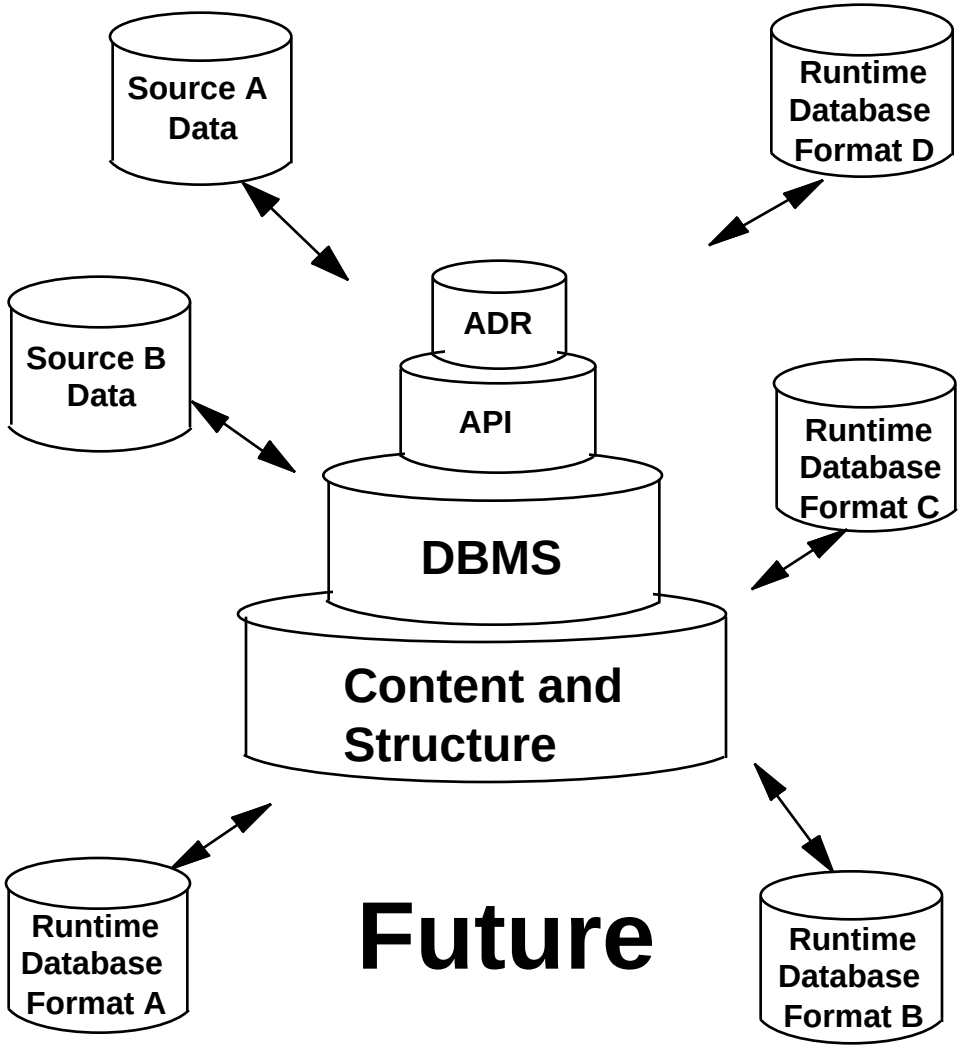
Data Interchange Format

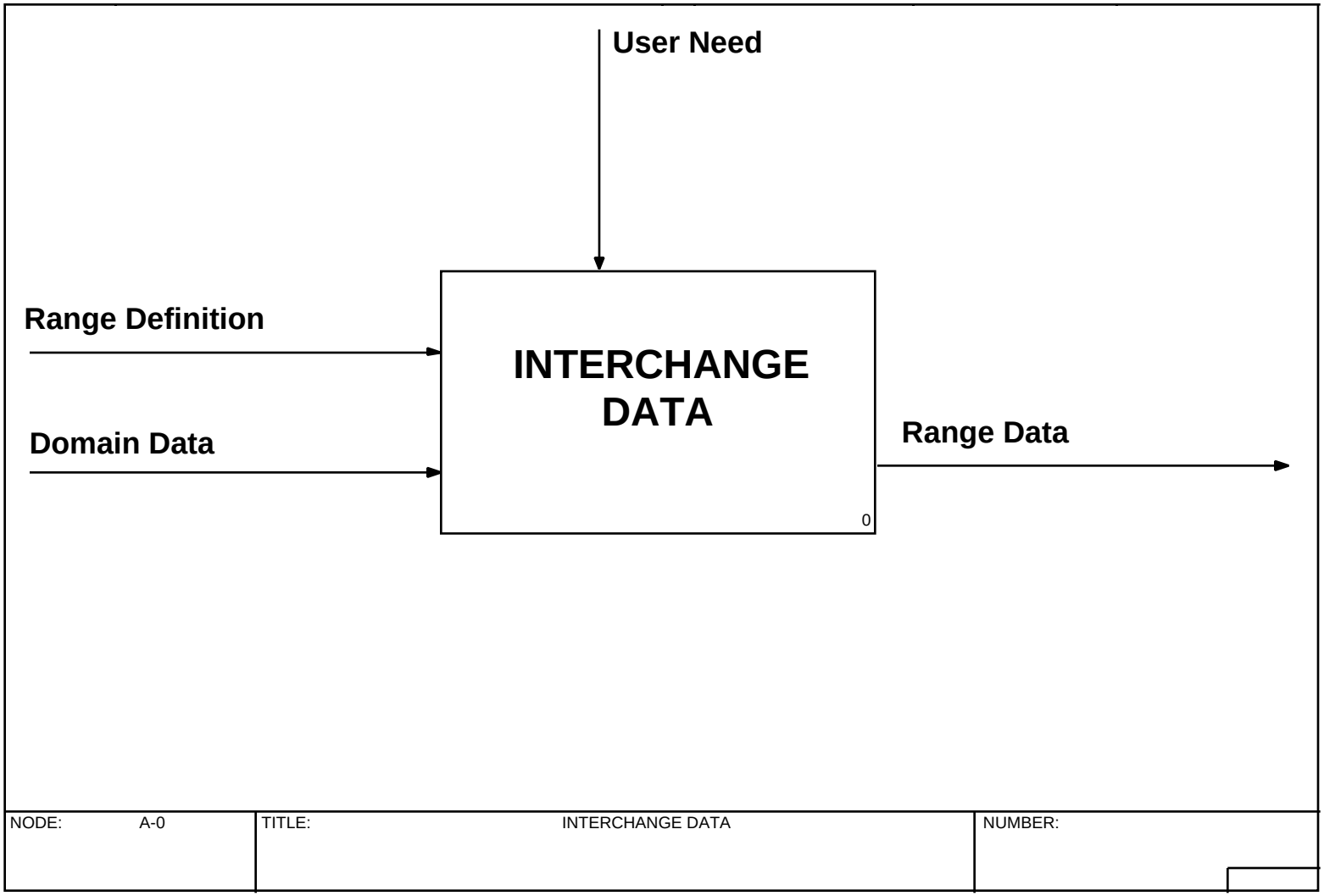


Today



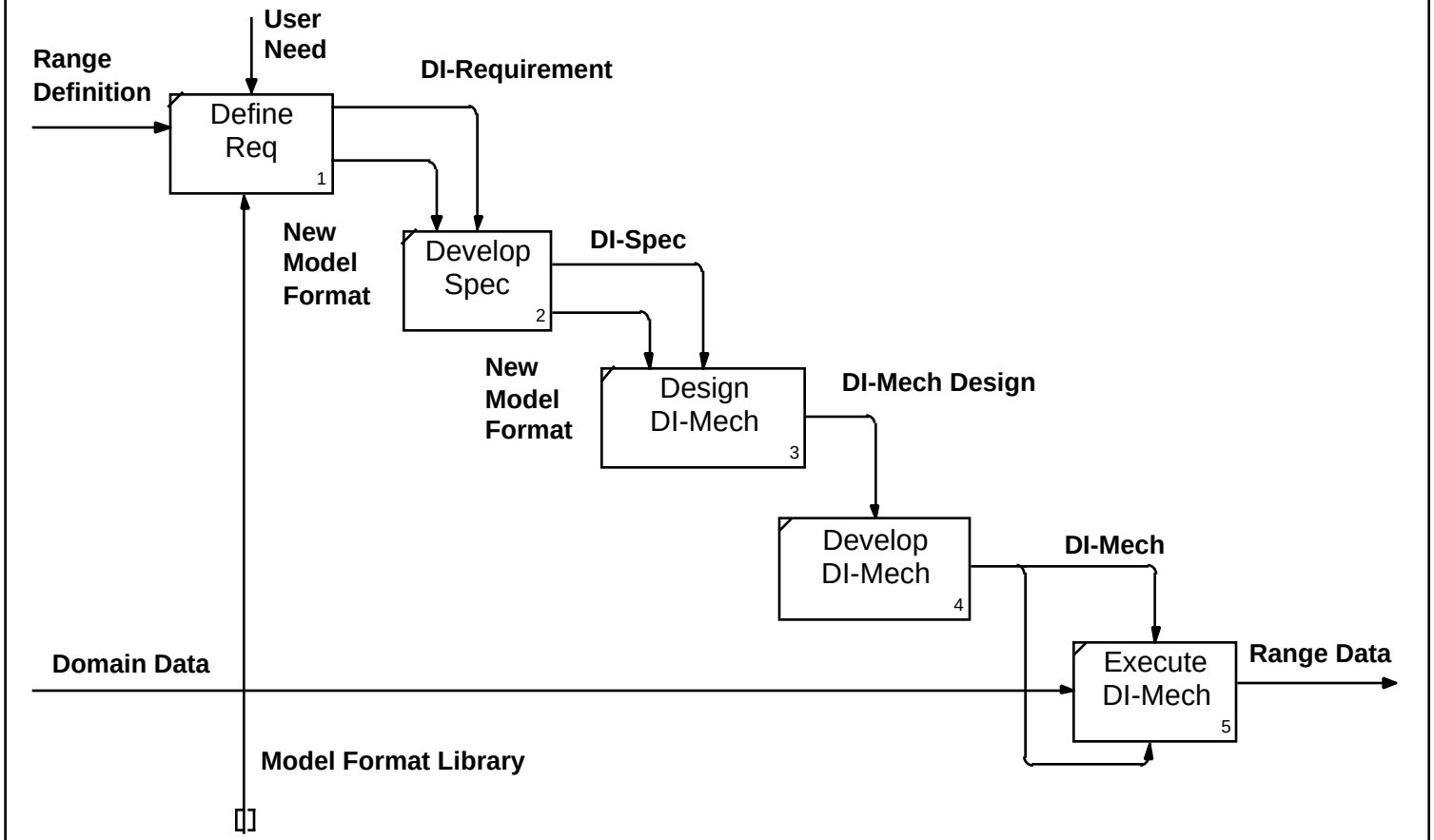
Future

Interchange Data



Interchange Data (Detail)

USED AT:	AUTHOR:	DATE: 16 Oct. 1996		WORKING	READER DATE	CONTEXT:
	PROJECT: Model 3	REV: 23 Oct. 1996		DRAFT		TOP
				RECOMMENDED		
	NOTES: 1 2 3 4 5 6 7 8 9 10			PUBLICATION		A-0



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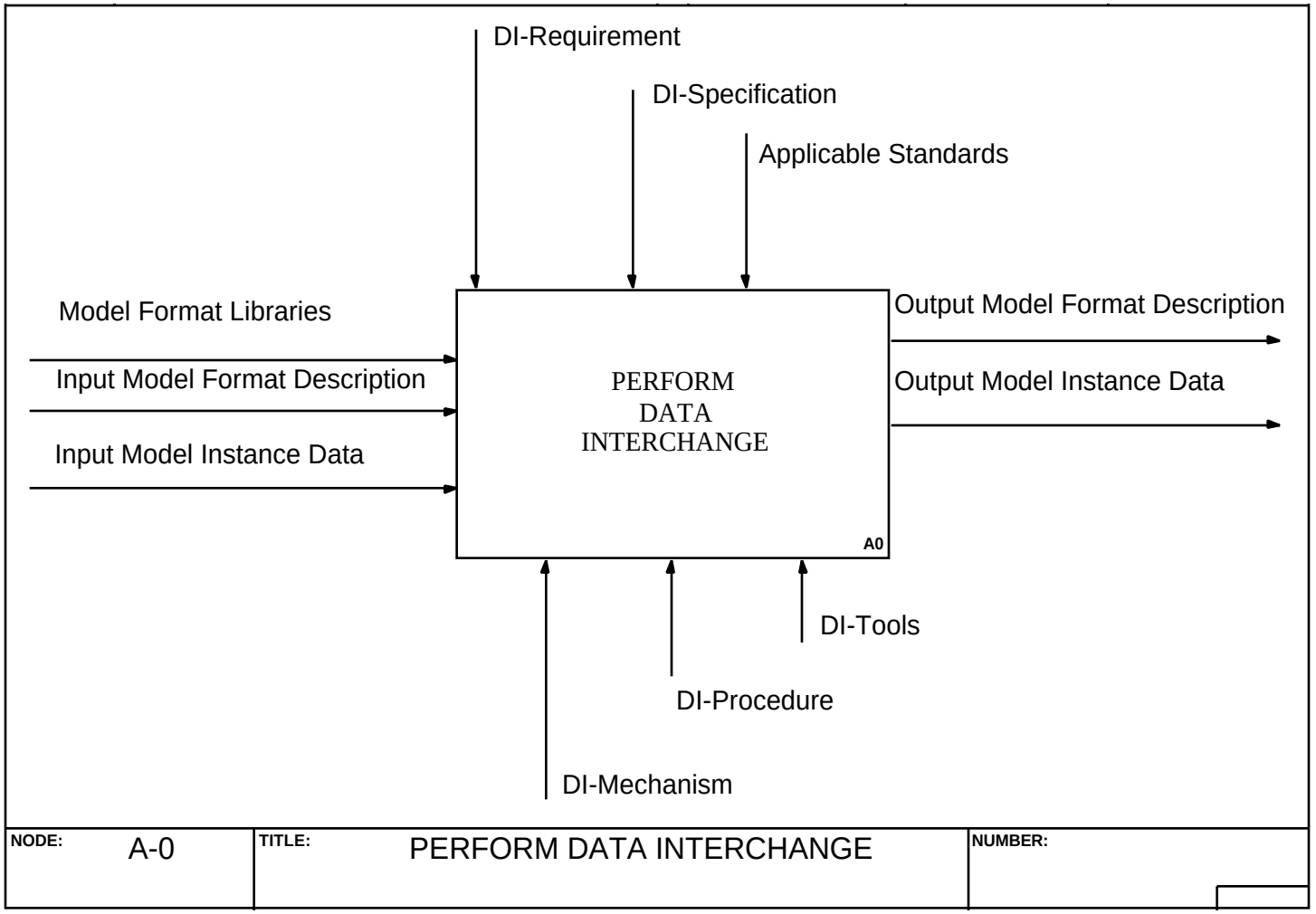
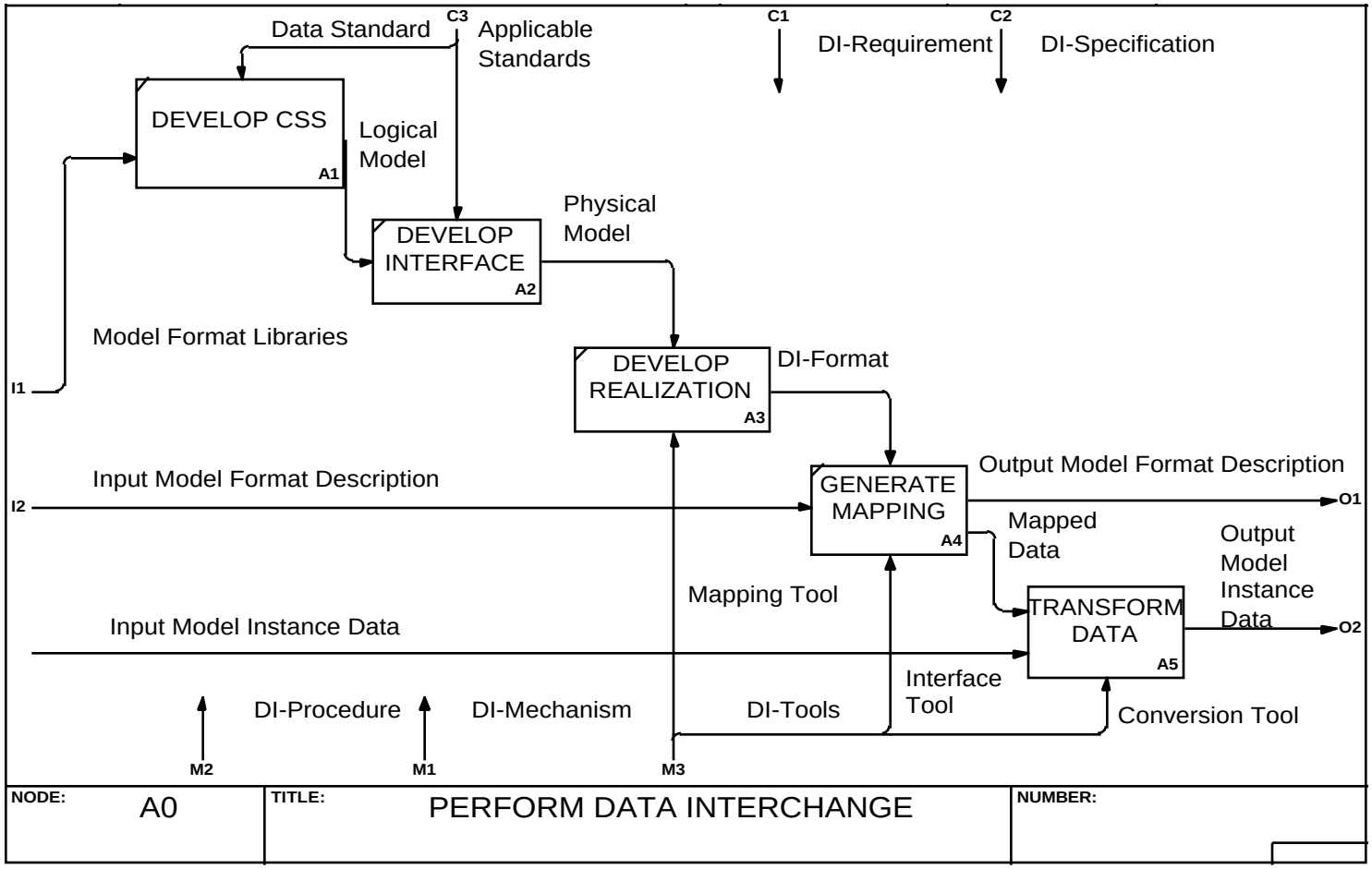
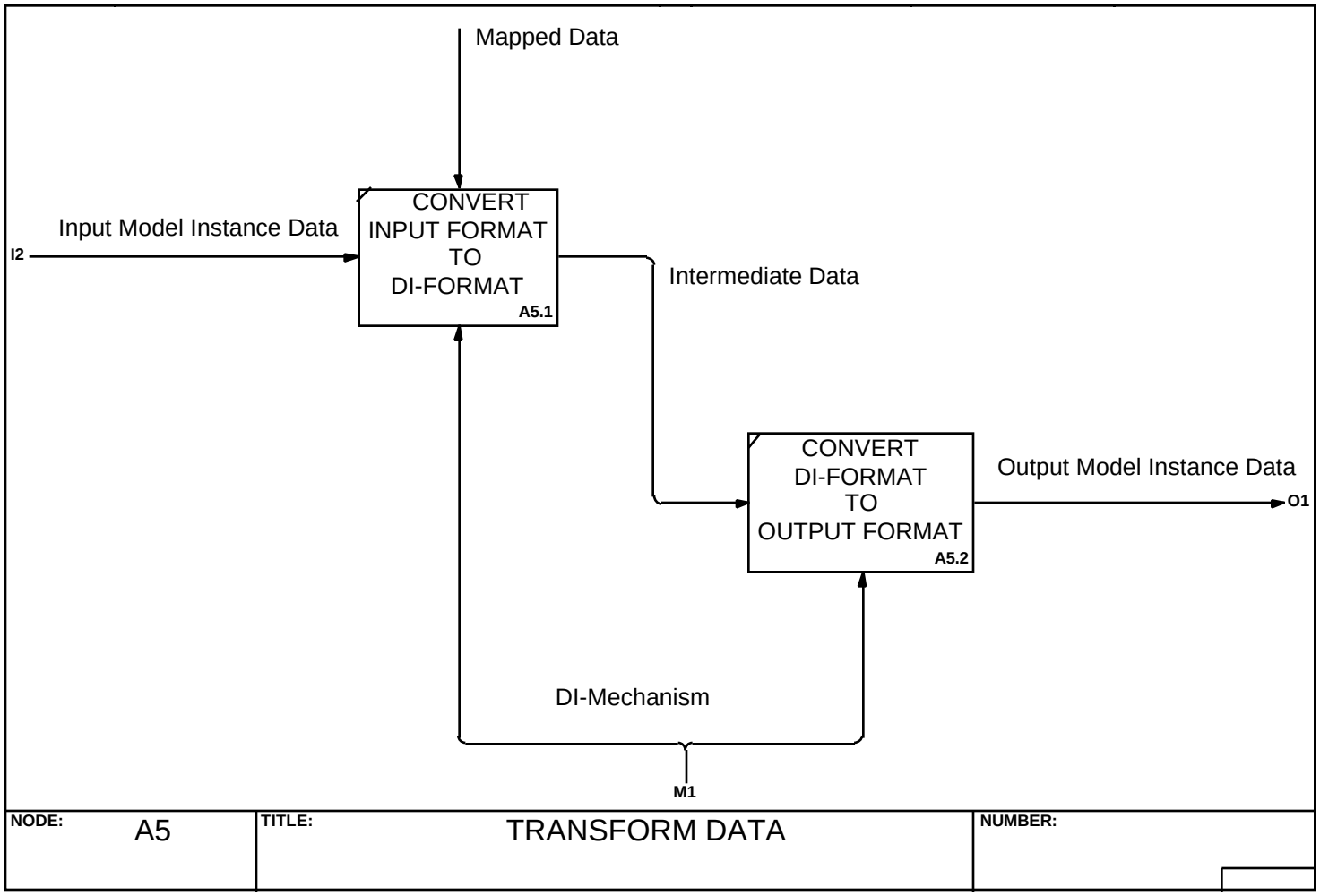
Perform Data Interchange (Top-Level)



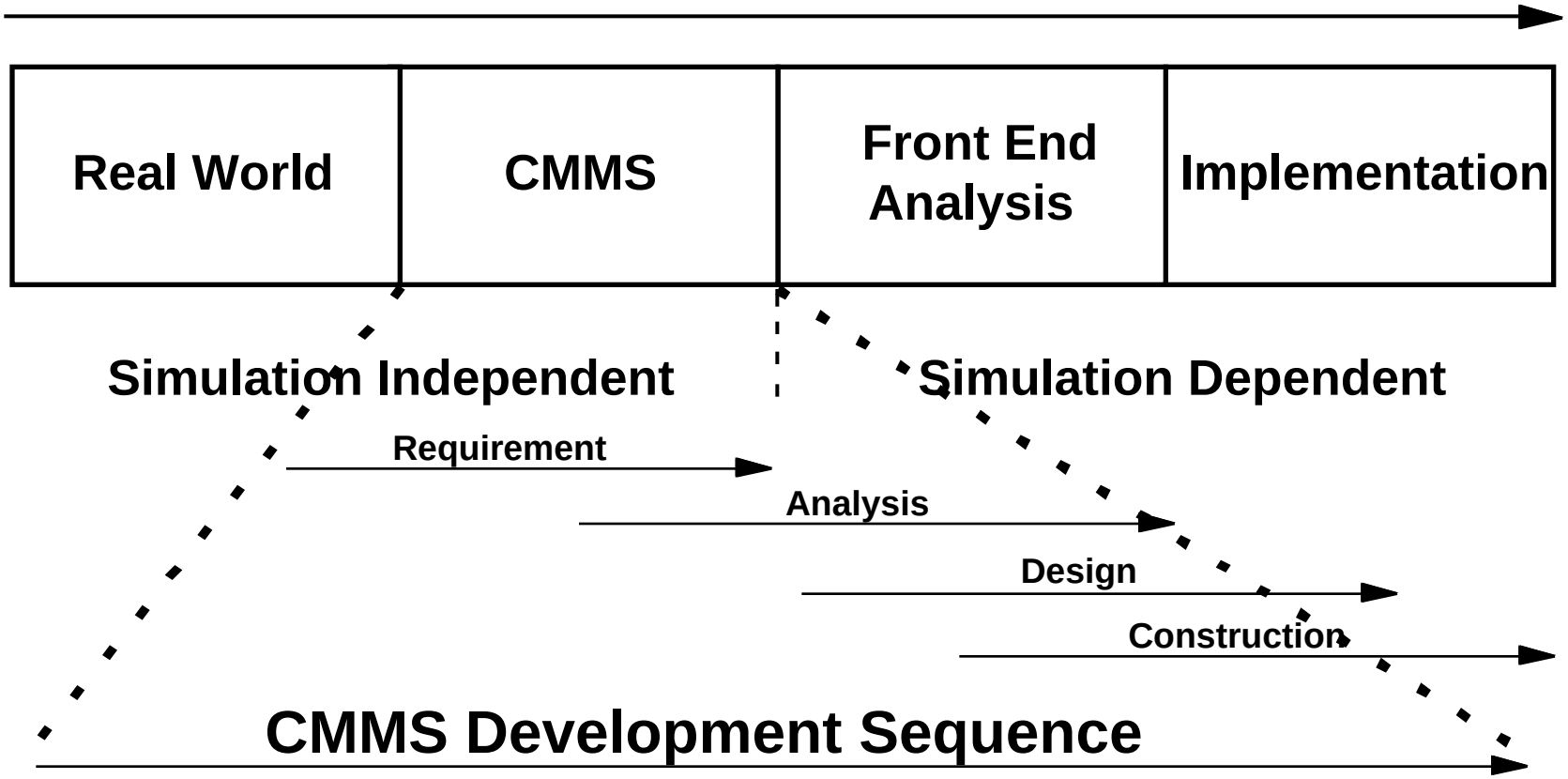
Perform Data Interchange (Detail)



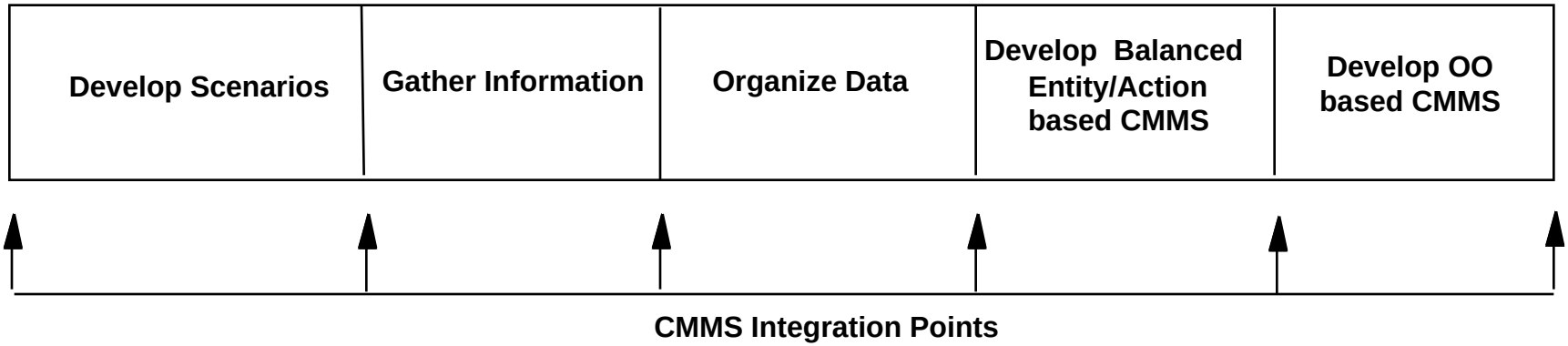
Conversion Detail



Simulation Development Sequence



CMMS Development Sequence



Common Scenarios Provide Context, Focus Priorities and Generates Interactions